CSIR NEWS

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Vegetable Raw Materials for Steroid Hormones and Oral Contraceptives: Symposium at NBG

The National Botanic Gardens (NBG), Lucknow, organized, in collaboration with the Department of Science and Technology of the Government of Uttar Pradesh, a three-day symposium on 'Production and utilization of vegetable raw materials for steroid hormones and oral contraceptives' from 26 to 28 March 1977. The symposium, which was attended by about 50 scientists, industrialists and policy makers actively engaged in this vital field of activity, was inaugurated by Dr Nitya Nand, Director, Central Drug Research Institute, Lucknow. Dr C. R. Krishna Murti, Deputy Director, Industrial Toxicology Research Centre, Lucknow, presided over the inaugural function.

In his welcome address, Dr T. N. Khoshoo, Director, NBG, highlighted the importance of the subject and its special relevance to the Indian conditions obtaining at the time. Other means of family planning and contraception having failed to find acceptance by the public at large, Dr Khoshoo observed, oral contraceptives offered a readily acceptable and reasonably fool-proof means of birth control. Explaining the aims and objectives of the symposium, Dr Khoshoo said that it had been organized with the main objective of making an appraisal of the production and utilization of steroid hormones and oral contraceptives, taking stock of the present state of R&D effort in the field, identifying gaps and suggesting measures to bridge them and preparing an operational programme at the state as well as at national level.

In his inaugural address, Dr Nitya Nand also stressed the importance of steroids and contraceptive steroids and dealt with the present status of their production and use in the country especially for the family planning programme. He said the country needed about 250 kg of contraceptive steroids per year for every one million women and the present production of these steroids fell much short of this requirement, which, if met by imports, would cost about Rs 2.50 crore. The country also needed about 5000 kg of corticosteroids, only half of which amount was being produced in India, and that too by foreign firms. It was, therefore, imperative that the production of the contraceptive steroids and corticosteroids was stepped up in the national sector to make the country self-sufficient in these commodities.

Dr Nitya Nand said that since there was no hope of preparing these compounds synthetically for decades to come, there was an urgent need for taking steps to make their natural sources available in abundant quantities. Extension of cultivation of diosgenin-yielding plants like *Dioscorea* and *Solanum* spp., and utilization of slaughter-house products, wool grease, sugarcane press-mud, etc. that yield cholesterol, phytosterols and stigmasterols used for the preparation of steroids, were the need of the hour.

Twenty-nine research papers were presented at the five sessions of the symposium, chaired by Dr E. K. Janaki Ammal, Dr R. K. Bammi, Dr S. C. Datta, Prof. D. K. Banerjee and Prof. R. N. Chakravarti respectively. The final plenary session, presided over by Dr Nitya Nand and convened by Dr T. N. Khoshoo, made the following recommendations :

(1) Phytochemical corporations be set up in various states/regions for undertaking R&D work on diosgenin-yielding and other medicinal plants and coordinating inter-state activities in this field.

(2) A CSIR-ICAR coordination cell be formed for coordinating the R&D work on medicinal plants being carried out in these organizations and for undertaking techno-economic surveys.

(3) Medicinal plants be recognized as plantation crops by the state governments and their cultivation exempted from land ceiling restrictions.

(4) Highest priority be given to the cultivation of *Dioscorea*, *Solanum* and *Costus* spp. in various parts of the country and countrywide R&D effort be made for their genetic upgrading, standardization of cultural practices for different agro-climates, availability of adequate amounts of propagating material and devising plant protection measures.

(5) A coordinated R&D work be initiated for the production of steroids from phytosterols and cholesterol to be obtained from sugarcane press-mud, soybean, wool grease, etc.

(6) A coordinated R&D work be initiated urgently by various research laboratories and the national sector of the pharmaceutical industry for the production, both by microbiological transformation and by total synthesis, of corticosteroids, which have a much larger demand than contraceptive steroids.

Seminar on Foundation Instrumentation

A seminar on Foundation Instrumentation was organized jointly by the Indian Geotechnical Society (Roorkee Chapter) and the Central Building Research Institute (CBRI), Roorkee, at CBRI on 14 May 1977.

Prof. Dinesh Mohan, Director of CBRI, who inaugurated the seminar, said that foundation instrumentation was the most powerful vehicle to travel the gap between prediction and performance and to advance the science of soil mechanics. CBRI had already undertaken development of indigenous piezometers, settlement gauges and pressure cells. The Director pleaded that the organizations such as Research Designs and Standards Organisation (RDSO), Lucknow; Maharashtra Engineering Research Institute, Nasik; IITs; universities; Central Road Research Institute; and CBRI on one hand and private entrepreneurs on the other, should work together in a spirit of cooperative endeavour.

The three lectures delivered at the seminar were on (i) Development of soil pressure cells in India, by Shri H. C. Verma, Chairman and Managing Director, Associated Instrument Manufacturers (India) Pvt. Ltd; (ii) Foundation instrumentation at the metropolitan transport project, Calcutta, by Shri B. K. Palit, Additional Director, RDSO; and (iii) Experience with foundation instrumentation and requirements of geotechnical engineering society, by Dr R. K. Bhandari, Head of the Soil Engineering Division of CBRI. These lectures were followed by discussions.

A resolution was passed recommending the creation of a study group under the aegis of Indian Geotechnical Society to survey the present status of foundation instrumentation in India, to serve as a data bank and to suggest priorities for future work.

IIP Develops Tacho-corder

A low-cost tacho-corder for indicating and recording the speed in spark ignition engine powered vehicles has been developed at the Indian Institute of Petroleum (IIP), Dehra Dun. This device picks up the signal from ignition coil and is capable of driving a 100 mV potentiometric recorder calibrated in rpm. The IIP tacho-corder has also the provision for connecting an ammeter of 0-5 mA range. The instrument developed at IIP does not require any power supply and pickup. It can pick up signals from the ignition coil and is suitable for one- and four-cycle engines. This device is economical as the use of costly components and pickup has been eliminated. It will be very useful in fuel economy and conservation studies.

The specifications of the tacho-corder are : range, 0-6000 rpm; and accuracy, better than 1.5% fsd.

The instrument finds application in measurement and recording of speed (rpm), and performance evaluation of IC engines.

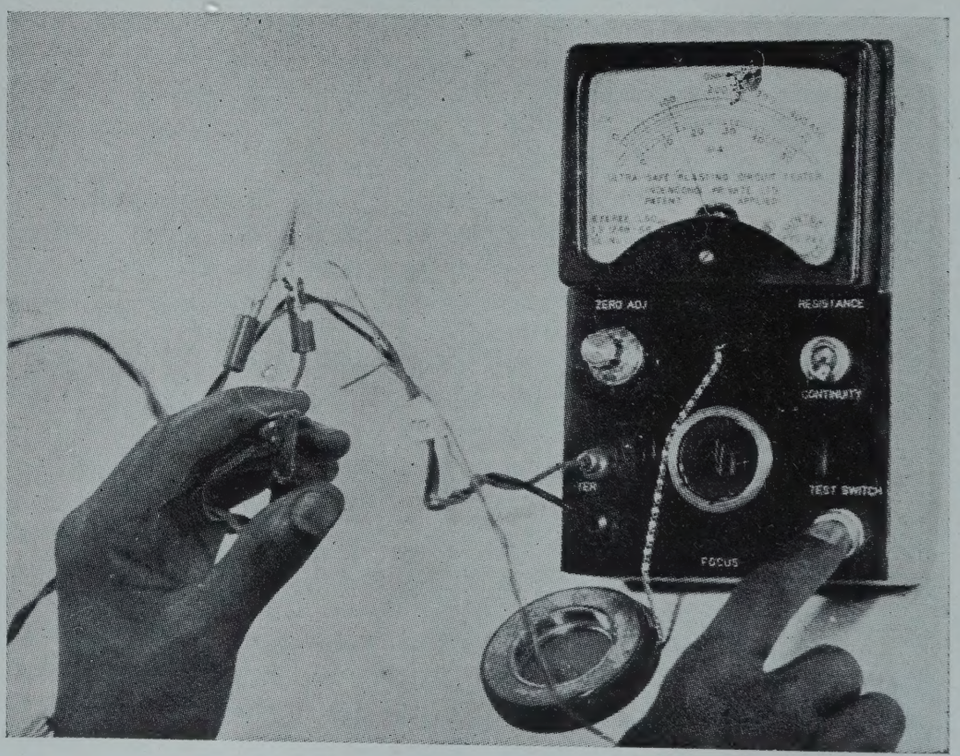
Ultra-Safe Blasting Circuit Tester

The Central Mining Research Station (CMRS), Dhanbad, has developed an ultra-safe blasting circuit tester which can be used without any risk, even in highly gassy atmosphere, for checking continuity and measuring the resistance of a blasting circuit.

A selenium photovoltaic cell on it has been utilized as a source of energy for its operation. The instrument is housed in a metallic box. A wooden or a plastic box can also be used for this purpose. The top cover has a meter calibrated in ohms, an opening for the photocell, a sensitivity control unit, two terminals for connecting the circuit and a push button switch for conducting test.

During operation, light is first beamed exactly on the photocell from a fully charged cap lamp head-piece and as a result electric current is generated. The magnitude of the current is then measured from a micro-ammeter connected in the circuit. A resistance connected in parallel to the ammeter controls the current flowing through it. The indication on the ammeter is directly proportional to the resistance of the external circuit.

Discontinuity in the external circuit is indicated by full-scale deflection in



Ultra-safe blasting circuit tester developed at CMRS, Dhanbad

the meter, whereas resistance is indicated by a finite deflection.

Other blasting circuit testers available in the market operate on a dry cell. The stored energy in a dry cell often brings about accidental firing, resulting in loss of lives and equipment. With the CMRS developed instrument such mishaps can be avoided, as the current generated when light falls on the photocell is too less in magnitude to do so. This amount of current is unable even to ignite any inflammable gas. As such, this instrument not only eliminates recurring expenses on account of battery but also does not require any test for intrinsic safety.

As there is no chance of accidental firing with this novel design, the circuit can be tested on the spot itself. Consequently considerable time required for checking discontinuity can be saved. This is advantageous particularly in large open-cast blasting or in places where access to the blasting site is not easy after making the circuit connection.

The device has now been commercially exploited and has appeared in the market.

BTRA 'PEP' Unit for Autoconer

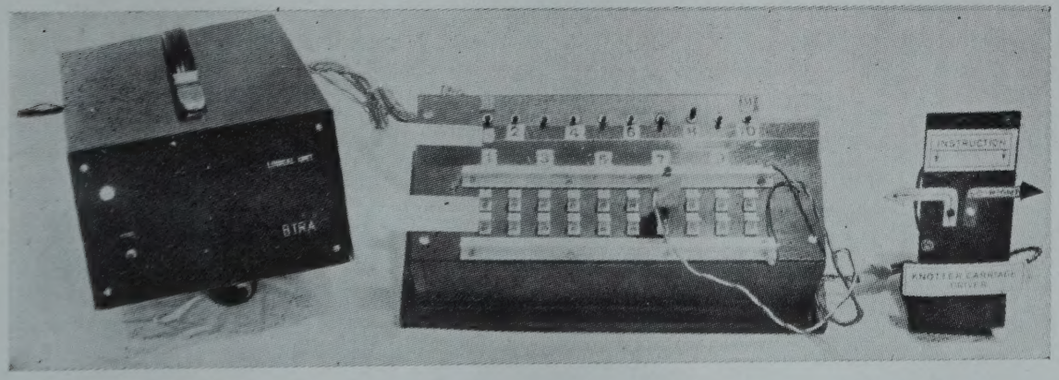
In textile industry, winding is an important operation. Spun yarn on bobbins is wound in the form of larger packages known as 'cheeses' or 'cones'. Autoconer manufactured by Schlafhorsts is a popular machine used for winding. On this machine, a number of spindles carry on winding simultaneously. The yarn being wound is prone to breakage and this interrupts the winding process. The process is also interrupted when the yarn on the bobbin is exhausted. A mechanical 'knotter' is employed, for each group of ten spindles, to resume the interrupted process. This knotter moves from one end of the section to the other, piecing yarn breaks or effecting bobbin changes on its way. The Bombay Textile Research Association (BTRA), Bombay, has developed an electronic attachment for improving the knotter performance of an autoconer.

Improvement in knotter performance is realized by a change in the usual patrolling mode. The conventional end-to-end movement of the knotter is replaced by another in which it approches the nearest idle spindle. Specifically, the reversals of the knotter can occur anywhere along its patrolling range.

With this modified patrolling mode, the total idle time of spindles is minimized and production is increased. It is, therefore, known as the production enhancing patrolling (PEP) mode and the device as PEP unit.

The PEP unit comprises three subunits, viz. interface unit, logical unit, and guidance unit. The interface unit receives information regarding the status of all the ten spindles and delivers it to the logical unit. The logical unit processes this information and takes decision. These decisions are then conveyed again through the interface unit to the guidance unit which is located on the moving knotter itself and is connected to its driving motor.

The salient features of the PEP unit are : (1) it increases knotter efficiency, reducing the winding cost; (2) it has a reasonable payback period and negligible operating cost; (3) the unit is compact and occupies no extra floor space; and (4) it has the advantage of ease of installation without any risk to the machine and needs minimal maintenance. A special feature of the unit is the possibility of instantaneous reversal to conventional mode of operation. It is completely indigenous.



BTRA 'PEP' unit for autoconer

Ceramic Products from Industrial Wastes

The Central Glass & Ceramic Research Institute (CGCRI), Calcutta, has developed a process which can replace the costly metal or china clay pottery by low-cost and durable potteryware made from fly ash of thermal power plants and red mud of the aluminium industry. These industrial wastes are not being utilized at present. These wastes can also be used to produce good-quality sanitaryware, low-tension insulators, wall tiles, floor tiles, glazed tiles, and strong red bricks for building purposes. The CGCRI process is simple and can be easily practised at the village level and, therefore, is expected to increase employment potential in the villages.

CGCRI has developed another process to produce slag ceramics, i.e. ceramics from blast furnace slag. Good-quality tiles have been produced through this process and are being used in the coke oven of the Bokaro steel plants. These tiles would eliminate the import of costly lining materials. The slag ceramics are extremely abrasion- and corrosion-resistant.

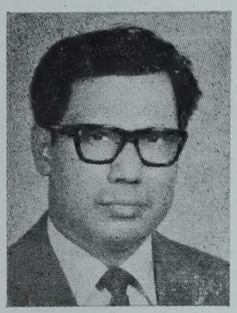
A process has also been developed for the production of acid- and abrasion-resistant glass ceramics from the waste slag from phosphorous plants. This slag can also be utilized for making amber-coloured container glasses.

Silicon nitride, an important refractory material possessing high strength and unique thermal shock resistance, has been developed at CGCRI. The product has extremely high corrosion resistance towards molten metals like aluminium, zinc and lead. It could also resist corrosion by molten copper.

TRANSPORT PHENOMENA IN COMPOUND SEMICONDUCTORS

Bhatnagar Prize-winner Prof. Nag's Work

Electronic equipment are mostly made today with semiconductor devices, which have been invented in the last three decades. These inventions resulted from the pursuit of the study of electron transport in semiconductors. Nag's researches have been concerned with such studies in compound semiconductors. He studied electron transport in these materials in low electric and magnetic fields, in high electric fields and for quantizing conditions.



Prof. B. R. Nag

The predominant electron scattering mechanism in compound semiconductors, the polar optical phonon scattering being inelastic and non-randomizing, transport coefficients for these materials cannot be accurately evaluated by the commonly employed relaxation time formalism. Variational method cannot also be formally employed for the calculation of transport coefficients other than the dc mobility. Nag developed a new method for the evaluation of the various transport coefficients including the effects of all the complexities of the energy band structure and of electron scattering mechanisms, and applied the method to study gallium arsenide, indium antimonide, indium phosphide, mercury cadmium telluride, lead telluride and aluminium antimonide. By combining his theory with the available experimental results he was able to confirm the existing model of electron scattering in gallium arsenide, to give values of acoustic phonon deformation potential constant in indium antimonide, indium phosphide, lead telluride and aluminium antimonide, and to bring to light the effectiveness of an ordinarily forbidden scattering mechanism in mercury cadmium telluride.

Nag has been studying electron motion in high electric fields, the so-called hot-electron transport, almost since it was first experimentally demonstrated. His recent studies in this field were concerned with warm-electron transport coefficients, i. e. transport coefficient for moderate electric fields and with hot-electron diffusion coefficient. Warm-electron phenomenon is very sensitive to the nature of scattering mechanisms and it was studied thoroughly earlier in elemental semiconductors. A number of experiments were also reported on compound semiconductors in recent years. The theory available for the analysis of these results was, however, very limited in scope as it was based on the assumption of a displaced Maxwellian distribution function, which requires for its validity a large electron concentration. Nag's contribution in this field has been the development of a theory which is more valid for the experimental conditions. His theory explained the results for indium arsenide and brought to light the discrepancies in the experimental results of other materials.

Like the warm-electron coefficient, the diffusion coefficient is also very sensitive to the nature of scattering mechanisms. It is also an important coefficient which has a very significant effect on the performance characteristics of hot-electron devices, such as Gunn diodes and impatts. However, the characteristics of electron diffusion in high electric fields were not properly understood and the effects of diffusion were often studied using ill-founded relations. Nag developed a theory of hot-electron diffusion and gave a new diffusion equation and a new formula for the diffusion constant. This formula was found later to explain very well the experimental results for silicon. It was also predicted from the theory that under certain conditions the diffusive forces could lead to an instability and be the basis for new devices.

More recently, Nag has been concerned with electron motion in hetero-structures of gallium arsenide and gallium aluminium arsenide. Energy levels of electrons in these structures undergo size quantization and the continuous conduction bands break into minibands or discrete levels. New kinds of devices for microwave and millimetre wave amplification and generation have been suggested using these materials. However, the available experimental results on the properties of these structures are not yet properly understood. Nag has developed a theory of the quantized energy levels in the materials, which takes into account the complex energy band structure of the constituent materials. The observed optical absorption spectra and electron tunnelling current in these materials may be better understood from his theory. He has also studied the effect of a quantizing magnetic field on the energy bands in these structures. These studies brought to light new aspects of the energy band structure, which may be used for the realization of new light interaction devices.

Prof. B. R. Nag of the Centre of Advanced Studies in Physics and Electronics, Calcutta University, Calcutta, has been awarded the Shanti Swarup Bhatnagar prize in physical sciences for the year 1975 (jointly with Prof. K. L. Chopra) [*CSIR News*, **27** (1977), 57].

BITM Anniversary Celebrations

The Birla Industrial & Technological Museum (BITM), Calcutta, celebrated the eighteenth anniversary of its opening from 2 to 15 May 1977. The programme included, among other items, seminars on 'Traffic and transport of Calcutta' and 'Museums and education'; exhibitions on 'Traffic and transport of Calcutta', and 'Museums in education';

inter-school science quiz final; popular scientific lectures; display of mechanical toys; working demonstration of a robot, special closed-circuit television and film shows. The programme attracted more than 30,000 visitors.

Hysteresis in Clarke Solder Blob Junctions

In 1962 Josephson predicted that two superconductors when separated by a sufficiently thin insulating barrier would behave in many respects as a single block of superconductor. Josephson junction has been used to determine the ratio of fundamental constants *e* and *h*. Since the essential structure of a Josephson junction is two superconductors separated by a thin barrier, various barriers have been used, viz. thin oxide, polyester film and normal metal. Examples of different types of junctions are the Dayem bridge, point contact and Clarke junction. A study on hysteretic Clarke junctions was made by Mrs Madhu Prasad under the guidance of Dr M. S. R. Chari at the National Physical Laboratory, New Delhi.

A Clarke junction consists of two Josephson junctions in parallel, connected by a superconducting path. A double junction is also called the superconducting interferometer since the two junctions act as coherent sources and thus satisfy the essential criteria for interference effect. Hysteresis is said to occur in the current-voltage characteristics of these junctions when the path traversed by I-V curve in the reverse transit does not retrace the path followed in the forward direction. Hysteresis is well explained for single junctions while little work has been done on the cause of hysteresis in double junctions.

A comparative study was made of the hysteretic and the non-hysteretic junctions with regard to : (i) temperature dependence of the critical current, (ii) variation of critical current with sequential sweeps, and (iii) modulation characteristics.

All the experimental results were explained in terms of a nett trapping of magnetic flux within the junction loop. The origin of the flux could be traced to the presence of an inductance and the electric or geometric asymmetry. As a result of this study it has been conclusively proved that the measurement of critical current introduces a certain amout of trapped flux which is cumulative in nature. It was also demonstrated that hysteresis in these double junctions is due to the presence of a reactive element and not due to the formation of hot spots.

Mrs Prasad has been awarded a Ph. D. degree of the University of Delhi for her thesis based on these studies.

Collision Frequency and Temperature in F-Region of Ionosphere

Collision of free electrons in the ionized upper atmosphere with other particles controls absorption of radiowaves propagating through the medium. The electrons oscillate under the influence of the radiowave and if, during these oscillations, they collide with other molecules or positive ions, part of the energy in the radiowave is lost as kinetic energy of the colliding particles. The problem of collision frequency and temperature in the F-region of the ionosphere was studied by Shri R. Venkatachari of the National Physical Laboratory (NPL), New Delhi.

Shri Venkatachari's investigation concerned collision frequency of electrons in the F-region of the ionosphere (or the ionized region in the upper atmosphere at heights of 200 km and above), the measurement techniques of ionospheric absorption of radiowaves, analysis techniques to obtain collision frequency from them—particularly the manner in which the effect of the earth's magnetic field can be taken care of in the analysis, and the correspondence of the collision frequency with electron temperature in the region.

A notable contribution of Shri Venkatachari has been to show how the effect of the magnetic field can be taken care of in the estimation of collision frequency from absorption measurements, both by the pulse absorption method and the cosmic radio noise technique. Previous workers, in general, did not employ these corrections. It has been found that with proper corrections all available results of previous measurements at various locations, as well as the measurements at Delhi, give consistent values of collision frequency, depending only on diurnal time and epoch of solar activity at which the absorption measurements are made. An empirical relation connecting collision frequency and kinetic temperature of electrons in the F-region, which changes with diurnal time and solar activity conditions, is suggested so that the temperature values obtained from collision frequency may agree with those obtained with other techniques as incoherent scatter and rocket-borne probes. Physical reasons in favour of the empirical relation (which differs from those given by plasma physicists) are given. The motion of free electrons is constrained in the earth's magnetic field, allowing more collisions to take place than a simplified theory would predict.

Shri Venkatachari has been admitted to a Ph. D. degree of the Andhra University for his thesis based on this work. The work was done at NPL under the guidance and supervision of Dr A. K. Saha of the laboratory.

PROGRESS REPORTS

RRL, Bhubaneswar
Annual Report : 1976

The annual report of the Regional Research Laboratory (RRL), Bhubaneswar, for 1976, published recently, shows that the laboratory continued its R&D activities in the following areas: Mineralogy and metallography, Mineral beneficiation, Pyrometallurgy, Hydro and electrometallurgy, Special materials, Inorganic chemicals, Forest and marine products, Aromatic and medicinal plants, and Design and project engineering. During the year the laboratory undertook 21

primary projects. The earnings of the laboratory through sponsored projects, testing, analyses and consultancy services during the year amounted to about Rs 1.66 lakh.

Investigations were carried out to beneficiate low-grade limestone on a 10-20 kg/hr scale. Based on the results obtained the economics of beneficiating 200 tonnes of limestone (containing 78% calcite) worked out by the laboratory showed that an additional cost of about Rs 20/tonne would be required for upgrading the limestone.

A process has been developed for the extraction of nickel on a 5 kg scale with 90% extraction of nickel from lateritic nickel ores of Orissa. It consists in reduction roasting of ores with a solid reductant, leaching with ammoniacal ammonium carbonate solution under aeration, separation of nickel and cobalt by solvent extraction, and winning of metals by electrolysis.

Studies were being carried out on column leaching of reduced ilmenite with hydrochloric acid under the sponsorship of Mettur Chemical and Industrial Corporation, Tamil Nadu. These studies include the reduction roasting of ilmenite followed by leaching of reduced ilmenite in column reactors. For reduction roasting, rotary kiln was perfected to reduce ferric oxide in ilmenite to ferrous oxide. Charcoal was found to be a better reductant than Talcher coal for reduction of ilmenite. About 40-50 kg of ilmenite could be reduced in the rotary kiln.

Laboratory-scale work has shown encouraging results on the bacterial leaching of low-grade copper ores from Mosaboni and Rakha mines in Bihar with mine waters of the respective mines which contain active species of microorganisms. The ores of Malanjkhand (Madhya Pradesh) were also responsive to bacterial-cum-chemical leaching. It is an inter-laboratory project.

The process for the simultaneous production of iron oxide red and sodium sulphate starting from ferrous sulphate and sodium carbonate was demonstrated and the know-how transferred to a party. Conditions were standardized for the preparation of iron oxide black starting from ferrous chloride solution obtained by the interaction of iron scrap and hydrochloric acid at 250 and 500 g/batch scales. The process has been patented and referred to NRDC for commercialization.

Laboratory-scale experiments for the preparation of chromic oxide with potassium bicarbonate as the starting material have been successfully completed. Samples evaluated by a ball-bearing industry were found satisfactory. The oxide is imported at present.

Vanadium sludge containing 8-20% vanadium pentoxide besides small quantities of phosphates and fluorides is a byproduct of alumina industry. A process has been developed for the production of ammonium vanadate by treating the sludge with ammonium and alkali salt solutions in stages to obtain pure ammonium vanadate as the end product. The byproducts phosphate and fluorides are separated as a calcium compound. Encouraging results were obtained on the preparation of chromium dioxide for use in magnetic recording tapes.

Iron and aluminium based cermets with carbides and oxides dispersion were being developed. Improved properties of the composites have been observed. Aluminium based cermets are likely to find application in automobiles, aircraft, etc. where light weight is an essential consideration. Iron with SiC cermet would find applications in plough tips, die lining, mineral and ore handling plants, rock drilling machines, etc.

In continuation of the work on the extraction of alkaloids from nux-vomica seeds, a new and improved process has been developed by which the mixed alkaloids are recycled into the mainstream and improved yields of the produce have been obtained. For the same processing cost, the yield of the products has been increased, resulting in overall economy.

Hecogenin is an important raw material for the manufacture of steroid hormones. A process for its manufacture from sisal juice (containing 0.13% hecogenin), a waste product in the sisal fibre industry, has been standardized on bench scale. For a plant processing one tonne of hecogenin acetate per annum the cost of production would be Rs 900/kg as compared to the international cost of the product at Rs 1200-1400/kg.

Thirty-three papers were published, 19 papers were presented at conferences and 10 patents were filed during the year.

PROCESSES AND PRODUCTS READY FOR COMMERCIAL UTILIZATION

Pepsin (I. P. Grade)

Pepsin is used in the pharmaceutical industry in multienzyme therapeutic preparations, for bating of leather and for giving lustre to silk thread, in the preparation of peptone, and in the food industry. A large amount of pepsin is imported, and in 1974-75, 9828 kg of pepsin, valued at Rs 8,21,570, were imported.

The Central Drug Research Institute (CDRI), Lucknow, has developed a process for preparing pepsin from slaughter-house waste. In the process, buffalo and goat stomachs are transported under chilled conditions from the slaughter-house. Residual food and unwanted material are removed by washing with running tap water. The inner mucosal linings are scraped under cold conditions, homogenized and incubated after adjustment of *p*H, the homogenate is filtered and the filtrate is dried under vacuum to a light yellow powder.

Work has been done on a laboratory scale. About 200 g of pepsin have been prepared from buffalo stomachs and 20 g from goat stomachs. The product has been tested by Unichem

Laboratories, Bombay, and conforms to I. P. specifications.

The smallest economic plant should be able to process 100 buffalo stomachs per batch yielding about 1 kg of pepsin.

The main items of plant and equipment required are : waring blenders (capacity, 2 litres), arrangement for filtration under vacuum or filter press, incubation room (10×10 ft^2) or steam-heated reactor (capacity, 100 litres), and vacuum shelf dryer.

All the raw materials are available indigenously.

The plant should be set up in a town with a sufficiently big slaughterhouse to ensure adequate supply of buffalo and goat stomachs.

After the removal of mucosal linings the residual stomachs may be processed to obtain transparent parchment or disposed of as waste. There are no problems of effluent disposal or pollution.

Further particulars can be had from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

PERSONNEL NEWS

Dr M. P. Dhir

Dr M. P. Dhir of the Central Road Research Institute (CRRI), New Delhi, has been appointed, on promotion, Scientist F at CRRI with effect from 22 March 1977.

Dr Dhir (born 14 March 1935) has had a brilliant academic career. He graduated with Honours (gold medallist) in civil engineering from Panjab University in 1955, obtained his master's degree in civil engineering in highest grade from Purdue University (USA) in 1961 and doctorate in engineering from Panjab University in 1968.

After serving the Punjab Government for a year as Design Engineer, Dr Dhir joined CRRI in July 1957 as Senior Scientific Officer. He has made notable contributions in applied pavement design including overlays and surface characteristics of pavements. He pioneered the development of indigenous equipment for measurement of surface characteristics of pavements.

Dr Dhir has handled a variety of road consultancy projects. His consultancy assignments include preparation of development plans for hilly regions, runway improvements for modern aircrafts, evaluation of pavement constructions at national/state levels, and assistance in the setting up of state road research laboratories. He has been closely associated with Indian Roads Congress (IRC) Road Tests Project.

Under UNDP assistance for this project, Dr Dhir visited USA in 1971 to study the latest instrumentation techniques pertaining to pavement research.

Dr Dhir is intimately associated with the CSIR project for application of science and technology for rural development. He is also actively connected with several rural development programmes in the country.

Dr Dhir, as a co-author, won the IRC medal for contribution to the design of runway pavement for modern aircraft. He is a member of some technical committees of state planning boards, IRC, ISI and various other agencies. He attended the third International Conference on Structural Design of Asphalt Pavements held in London in 1972. He has to his credit more than 110 technical papers and reports in the field of highway engineering.

Dr R. K. Ghosh

Dr R. K. Ghosh of the Central Road Research Institute (CRRI), New Delhi, has been appointed, on promotion, Scientist F at CRRI with effect from 22 March 1977.

Dr Ghosh (born 1 Feb. 1933) has had a brilliant academic career in Calcutta University (B. E., 1954; C. E., 1955) and in the Institute of Highway Engineering, Technical University of Dresden, Germany (Dr.-Ing., 1960). He was awarded the grade 'Summa cum laude', the highest of the four grades of merit and distinction offered by German universities, for his doctoral thesis. After serving in the civil engineering faculties of the Bengal Engineering College, Sibpur, and the Bihar Institute of Technology, Sindri, Dr Ghosh joined CRRI in August 1961 as Officer on Special Duty. In 1963, he was appointed Assistant Director in Rigid Pavements Division of CRRI.

Dr Ghosh was deputed, in 1964, to attend and present a paper at the Overseas Civil Engineering Conference in London, organized by the Institution of Civil Engineers, London. Under the CSIR-DAAD Exchange of Scientists Programme, Dr Ghosh visited, in 1972, the Otto Graf Institute for Material Research in Stuttgart, the Technical University of Munich, the Central Road Laboratory in Cologne and other research institutions in West Germany and studied the R & D activities in highway engineering.

Dr Ghosh presented papers on polymer concrete, gap-graded concrete, resin repair of concrete pavement and accelerated curing of concrete at international conferences/seminars organized by RILEM, Paris, Australian Road Research Board and American Concrete Institute.

Dr Ghosh has been largely responsible for : rationalizing the design and modernizing the construction techniques of cement concrete roads and airfields in the country; introducing in the country composite pavement with semi-rigid base as distinctly superior to conventional pavement, particularly

under adverse conditions of subgrade, climate, traffic, etc.; large-scale adoption of bonded rigid overlay and emergency repair techniques for airfields developed at CRRI under his guidance; and developing five new techniques for large-scale utilization of fly ash in the construction of roads and airfields, for optimum economy and performance.

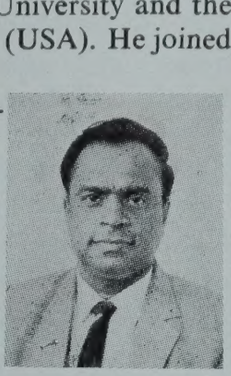
Dr Ghosh has to his credit about 120 research/technical papers, 4 patents, a large number of technical reports and reviews, and two technical books on influence lines for structures and puzzolanic clays of India. His work on hydrothermal stresses in concrete pavement, bonded rigid overlay, kinetic response of rigid pavement, gap-graded concrete, polymer concrete, lime-fly ash stabilization of soil and burnt clay puzzolana has won international recognition. He has been invited by the American Concrete Institute (ACI) to act as member of ACI Committees: 115-Current Research and 325-Concrete Pavements. He has also been nominated honorary guide-professor on rigid pavements at the World Open University, USA, and is a founder-member of the International Council for Gap-Graded Concrete Research & Applications. In 1974, he visited Maldives as a member of the Government of India expert delegation for evaluation of the international airport at Hulule and making suggestions towards its strengthening.

Dr Ghosh is associated, in various capacities, with 15 technical committees/panels of the Indian Standards Institution and the Indian Roads Congress in the field of rigid pavements; cement, puzzolana and concrete; and construction equipment. He is also the secretary of the Central Assessment Committee of the Ministry of Shipping & Transport.

Shri T. K. Natarajan

Shri T. K. Natarajan of the Central Road Research Institute (CRRI), New Delhi, has been appointed, on promotion, Scientist F at CRRI with effect from 22 March 1977.

Shri Natarajan (born 13 Jan. 1930) has had a distinguished academic career at the Annamalai University and the University of Illinois (USA). He joined CRRI in 1956 as Senior Scientific Officer and was promoted as Assistant Director in 1964, heading the Soil Mechanics and Foundation Engineering Division. Since 1975 he has also been heading the Civil Engineering Consultancy Service (CECON) of CSIR as its Chief Executive.



Shri Natarajan has made notable contributions in applied soil mechanics research by successfully tackling several difficult foundation problems, including landslide correction works and the building of a variety of structures under problematic foundation conditions such as soft marine clays, peats, and loose sands. He has been a consultant on a number of challenging earthwork and foundation assignments for most of the developing ports like Vishakhapatnam, Haldia, Kandla, Tuticorin, Goa and Paradip.

Shri Natarajan pioneered the application of vertical sand drains in India and conducted one of the biggest scientific field trials of its kind ever undertaken for establishing the limits of application of different types of drain wells (sand drains, sandwicks, etc.). He also pioneered the development of asphalt mulch technique and use of jute and coir nettings for erosion control in the treatment of surface landslides. Besides, he was the first to demonstrate the successful use of cinder as a material of highway embankment construction in India and to formulate a design methodology for building roads on rubbish fills. He worked assiduously to win the acceptance by the highway engineering profession of the philosophy of 'observational procedure of design' in the control of landslides and in the construction of embankments of soft ground; and as part of such contribution, pioneered the application of foundation instrumentation in the field of earthwork engineering. Besides, he has contributed to the evolving of specifications for the construction of roads of black cotton soils by successfully completing the IRC test track project. He has also been responsible for refining the methodology for the design of prestressed tierod anchors for stabilizing hillslopes.

Amongst Shri Natarajan's contributions to indigenous foundation instrumentation are the composite differential settlement-cum-tilt meter and the gauge for measuring deflection of component layers in experimental flexible pavements. He is the author of a handbook on 'Landslide Analysis and Correction' which represents a digest of experience with landslide correction jobs tackled by CRRI.

Shri Natarajan has won several awards and honours from organizations such as the Indian Roads Congress and Indian Geotechnical Society. He has published several research papers.

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The following personnel of the Publications & Information Directorate, New Delhi, have been promoted consequent on five-year assessment: Shri G. N. Sarma (as Scientist A; 23 Oct. 1975); Shri A.K. Gupta (as Scientist A; 6 Jan. 1976); Dr (Mrs) R.D. Kak (as Scientist A; 15 Sep. 1976); Shri A.K. Mandal (as Scientist A; 8 Nov. 1976); and Shri M. R. Chavan (as (Scientist A1; 3 March 1976).

Transfers

Shri M. S. Chawla, Section Officer, National Metallurgical Laboratory, Jamshedpur, has been transferred to the Indian Institute of Petroleum (IIP), Dehra Dun; Shri Chawla joined IIP on 27 May 1977.

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